The size of dental pulp chamber in adult diabetic patients

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Summary

The aim of this study was to determine differences in coronal pulp dimensions of first molars among adult insulin-dependent diabetics and non-diabetics and record the presence of pulp stones.
The patients of the study group comprised 56 insulin dependent diabetics (mean age 36.8 years). The control group consisted of 56 non-diabetic subjects (mean age 35.5 years) who were referred to our clinic. The radiographic examination was carried out, comprising periapical radiographs of first molars for each patient. They were taken under standardized conditions. The films were digitally scanned and nine measurements were made from the image of each first molar. The evaluated teeth were all intact.
A total 165 teeth were analyzed. No significant differences were found in the crown height, total pulp area, coronal pulp area, area of the clinical crown, heights of the mesial and distal pulp horns between type I diabetics and non-diabetics ($p > 0.05$).
The results of this study reveal that type I diabetes mellitus does not cause any changes in dental pulp size from the periapical radiographs.

Key words: dental pulp chamber, insulin-dependent diabetes mellitus.

Introduction

Type I (insulin-dependent) diabetes mellitus is associated with a deficiency or an absence of beta cells, the insulin-producing cells in the islets of Langerhans of the pancreas. Type I occurs in 10% of diabetic patients. These patients usually develop disease before the age of 25 [1]. An important consideration in diabetes mellitus is the vascular system. Blood vessels of all sizes are affected, from the aorta to the smallest capillary and venules [2]. Blood vessels are damaged by the accumulation of atheromatous deposits in the intimal tissues of the blood vessels lumen. Pulps of patients who suffer from diabetes mellitus tend to age more readily because of obliterative endarteritis and because the dental pulp of the fully developed tooth has limited collateral circulation. The impaired vasculature also interferes with tissue nutrition, pulpal repair, and creates a microaerophilic state for anaerobic development [2,3]. Detailed human pulp studies, at present, do not exist in diabetes mellitus. Histopathologic pulp observations in human diabetics are limited, and thus far, only two human histologic pulp studies have been reported according to computer analysis: *Russel* [4] reported that the changes observed in the periodontal tissue were the same as in the pulps, angiopathies, and a thickened basement membrane. These changes were located in both large and small pulp vessels. On the other hand, *Bissada and Sharawy* [5] found no vascular changes in the dental pulps of diabetics.

These findings raise the question that the arteriosclerotic changes observed in diabetes mellitus could decrease the pulp volume.

The aim of this study was to determine differences, if any, in coronal pulp dimensions of first molars among adult insulin-dependent diabetics and non-diabetics and record the presence of pulp stones from periapical radiographs.

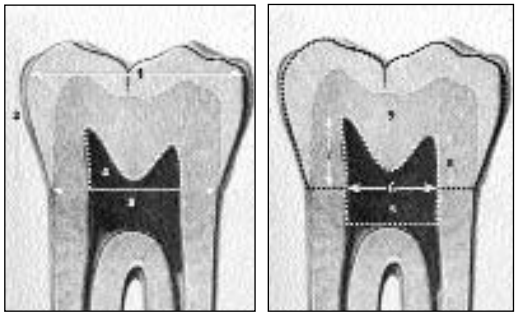
Material and Methods

Periapical radiographs of first molars were taken from 56 insulin-dependent diabetics (mean age 36.8 years) who were taking insulin preparates.

The control group consisted of 56 non-diabetics subjects (mean age 35.5 years) who were referred to our clinic with no systemic disease and no medication. None of the female patients were pregnant. A total 165 teeth were analyzed and the evaluated teeth displayed no caries and restorations.

Kodak D speed 3 cm x 4 cm periapical films were used. All radiographs were taken by a dental x-ray unit [Trophy Type, Novelix Beoubourg, France] with 70 kV, 10 mA using the paralleling technique. The film holder made by RINN Company was used for the paralleling technique. Film processing was automatic (Velopex Extra-X [Medivance Instrument Limited, London, UK]) using Kodak developer and fixer solutions. Radiographs of 112 individuals (165 first molars) were coded and then digitally scanned using an Epson Expression 1600 Pro scanner (Seiko Epson Corp., Japan). Image calibration was made.

Nine measurements were made of the images of the maxillary and mandibular first molars using the Scion Image program (Scion Corp., USA) [6] by one operator who was unaware of patient details *(Figures 1a, 1b).* A line was drawn across the tooth amelocemental margins, the area above this being termed the clinical crown. Mesiodistal crown width, crown height, crown width at the cervix, pulp width at the cervix, the heights of the mesial and distal pulp horns, and coronal pulp area were assessed. The total pulp area (above a line across the most superior part of the pulpal floor) and pulp area in the clinical crown were also recorded. The presence of any pulp stone was noted. In three pilot studies reliability of measurements was checked and a high correlation of repeated measurements was found (r = 0.90, 0.91 and 0.90 respectively).



a **b**

Figure 1 a-b. 1 - Mesiodistal crown width; 2 - crown height; 3 - crown width at the cervix; 4 - pulp area in the clinical crown; 5 - the total pulp area; 6 - pulp width at the cervix; 7 - height of mesial pulp horn; 8 - height of distal pulp horn; 9 - crown area.

Results

A total of 165 teeth were analyzed. There were 85 maxillary molars and 80 mandibular molars. Measurements were made of the images of 45 maxillary and 37 mandibular molars of Type I diabetics and 40 maxillary and 43 mandibular molars of the non-diabetics. Means and standard deviations of nine measurements made per tooth are shown in *Table 1.*

Maxillary first molars

Student t-test for equality of means showed that in the maxillary teeth there were no significant differences in the crown height, total pulp area, coronal pulp area, area of the clinical crown,

Table 1. Mean values of first molar dimensions

	Type I diabetics n = 45		**Non-diabetics n = 40**	
	Maxillary (SD)	**Mandibular (SD)**	**Maxillary (SD)**	**Mandibular (SD)**
Mesiodistal crown width (mm)	10.60 (0.66)	11.09 (0.69)	10.99 (0.51)	11.49 (0.57)
Crown height (mm)	5.42 (0.91)	5.56 (1.09)	5.21 (0.78)	5.31 (0.89)
Crown width at cervix (mm)	8.29 (0.57)	9.00 (0.76)	8.69 (0.82)	9.44 (0.66)
Coronal pulp area (mm^2)	1.98 (1.19)	2.11 (1.30)	1.58 (0.68)	1.62 (1.03)
Total pulp area (mm^2)	3.68 (1.40)	4.34 (1.88)	3.19 (1.14)	4.30 (1.57)
Pulp width at cervix (mm)	1.92 (.57)	3.23 (0.66)	1.66 (0.45)	3.32 (0.49)
Height of mesial pulp horn (mm)	1.00 (0.50)	0.91 (0.46)	0.82 (0.37)	0.70 (0.32)
Height of distal pulp horn (mm)	0.68 (0.34)	0.58 (0.34)	0.59 (0.23)	0.46 (0.24)
Crown area (mm^2)	56.68 (9.54)	55.22 (9.64)	59.25 (6.07)	57.49 (8.17)

Table 2. Prevalence of pulp stone in diabetics and non-diabetics

	Maxillary		Mandibular	
	Type I diabetics	**Non-diabetics**	**Type I diabetics**	**Non-diabetics**
Pulp Stones %	35.6	21.6	10	9.3
Significance (p)	0.006		0.124	

heights of the mesial and distal pulp horns between type I diabetics and non-diabetics ($p > 0.05$).

Between type I diabetics and non-diabetics, statistically significant difference was found in the mesiodistal crown width ($p < 0.01$). The mean values were 10.6 ± 0.66 and 10.9 ± 0.51 respectively.

The crown and pulp widths at the cervix were significantly greater in the maxillary first molars of type I diabetics than in those of non-diabetics ($p < 0.01$, $p < 0.05$ respectively).

In the maxillary molars, the mesiodistal crown width, crown and pulp widths at the cervix were significantly greater than in mandibular molars in both groups ($p < 0.05$).

Type I diabetics had more pulp stones than non-diabetics in first maxillary molars ($p < 0.01$, *Table 2).*

Mandibular first molars

Student t-test for equality of means showed that in the mandibular teeth there were no significant differences in the crown height, pulp width at the cervix, total pulp area, coronal pulp area, area of the clinical crown, height of the distal pulp horn between type I diabetics and non-diabetics ($p > 0.05$, *Table 1).*

Statistically significant difference was found in the mesiodistal crown width of mandibular first molars between type I diabetics and non-diabetics ($p < 0.01$). The mean values were 11.0 ± 0.69 and 11.4 ± 0.57 respectively.

There was statistically significant difference in the crown width at the cervix and height of the mesial pulp horn of mandibular first molars between type I diabetics and non-diabetics ($p < 0.01$; $p < 0.05$ respectively).

In the mandibular first molars there was no significant difference in the presence of pulp stones between type I diabetics and non-diabetics ($p > 0.05$, *Table 2).*

The total pulp area of mandibular first molars in non-diabetic patients was larger that that of maxillary first molars ($p < 0.05$).

There was no significant difference in the size of maxillary and mandibular first molar related to gender ($p > 0.05$) in both groups. Also no significant difference was found between the presence of pulp stones and gender ($p > 0.05$).

Discussion

Diabetes mellitus is a chronic metabolic disorder affecting at least 7.2% of the population in Turkey [7]. Major medical complications associated with diabetes include peripheral vascular disease and neuropathy [8]. There is no study about radiographic measurement of pulp dimensions in diabetics. Other studies of pulp chamber shape have excluded molars [9], did not include first molars [10], involved mandibular teeth only [11] or featured fewer than 10 teeth [12]. Digitizing the original standardized radiographs is an approach that allowed both image magnification and linear and area measurements with reproducible results.

Previous investigators used dental radiographs for measuring pulpal area [10, 11, 13, 14]. *Chandler et al* [6] investigated the effects of restorations on pulp size and found that teeth restored with occusal and proximal restorations had significantly smaller pulps but pulp area in the clinical crown related to the restoration types did not differ. In the present study we examined intact first molars. There were no significant differences in the crown height, total pulp area, coronal pulp area, area of the clinical crown, heights of the mesial and distal pulp horns between type I diabetics and non-diabetics. The measurements of the pulp chamber show that diabetes mellitus does not make the coronal pulp area to decrease. Mesiodistal crown widths, crown and pulp widths at the cervix of first maxillary molars and heights of the mesial pulp horns of first mandibular molars in diabetics were greater than in non-diabetics but these are not important for clinical assessment.

Chandler et al [6] found mandibular total pulp areas to be larger than maxillary total pulp areas. This is in accordance with the present findings: among non-diabetics the mandibular first molars had larger total pulp area than maxillary first molars. This probably represents the greater clarity of the pulpal image in the mandibular molars where the pulp space (and particularly the pulp horns) could be more easily defined and measured.

Pulp stones have been seen in a close association with suggested calcific change following minor circulatory disturbances [15]. In diabetics, calcifications were more frequent [4]. *Bissada and Sharawy* [5] observed calcified bodies in the pulp of diabetics. Similarly, there were more pulp stones in type I diabetics (35.6%) than in non-diabetics (10%) in first maxillary molars of the present study. *Ranjitkar et al* [16] found that the prevalence of the pulp stones was similar in males and females. In this study there was no significant difference between the presence of pulp stones and gender.

The results of this study show that type I diabetes mellitus does not cause any changes in dental pulp size from the periapical radiographs.

In conclusion, further work is required to determine the relationship between arteriosclerotic changes and pulp volume in diabetics.

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